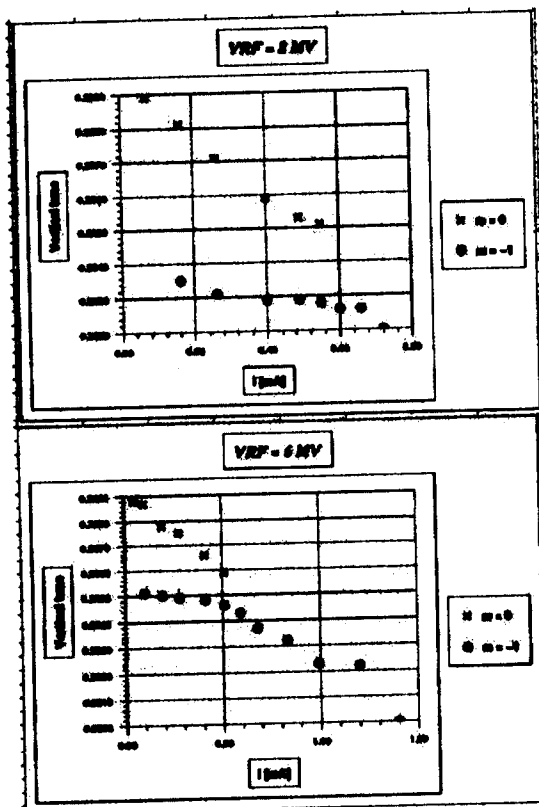


Mode-Merging Instability and Dipole Mode Frequency Measurement for the BB Impedance Characterisation

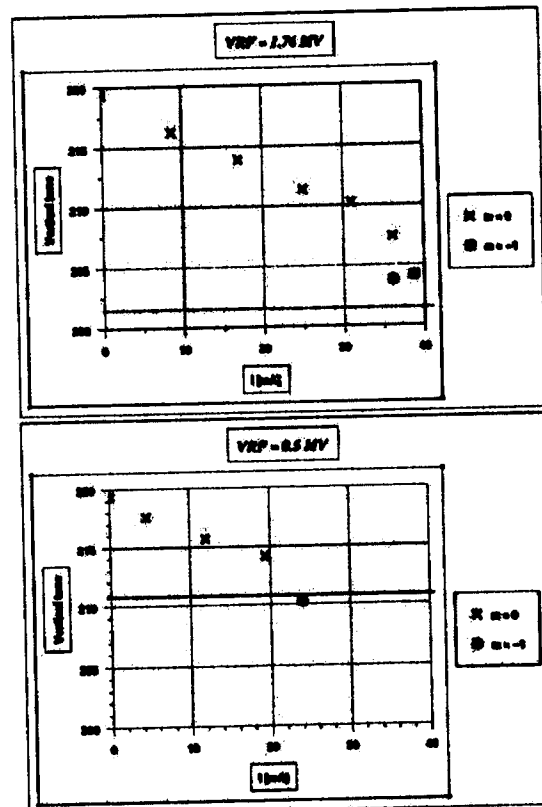
(G. Besnier, Ph. Kernel, R. Nagaoka, J.L. Revol and L. Tosi)

Partly in collaboration between the ESRF and ELETTRA

- Comparison of mode-merging instability between the ESRF and ELETTRA and its dependence on the RF voltage:



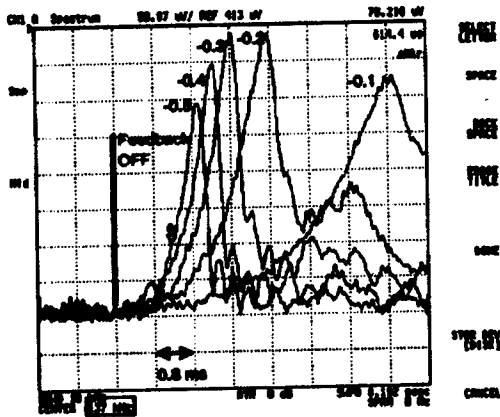
Mode-merging measured at the ESRF
 $f_{res} = 22 \text{ GHz}$, $R_T \beta = 13 \text{ M}\Omega$, $Q = 1$



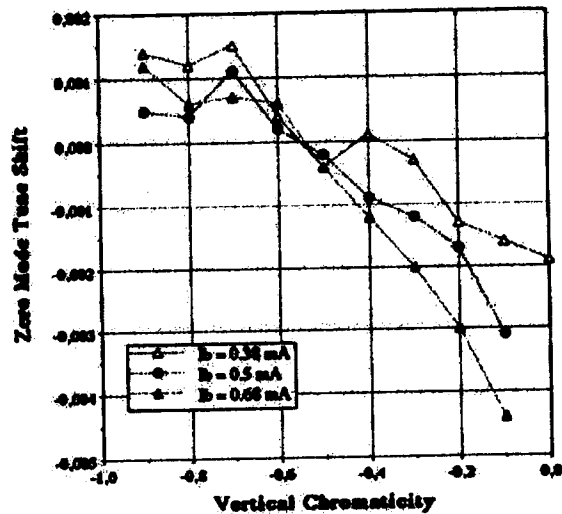
Mode-merging measured at ELETTRA
 $f_{res} = 5 \text{ GHz}$, $R_T \beta = 0.6 \text{ M}\Omega$, $Q = 1$

- Detailed observations of the mode-merging instability enable one to characterise the BBR parameters of the machine.
 (f_{res} influences the merging frequency, while $R_T \beta$ affects the threshold current)
- A vertical feedback can increase the threshold current by *as large as a factor of ~5*, but this only corresponds to $\sim 3.5 \text{ mA}$ ($\ll 15 \text{ mA}$).
- The mode-merging threshold of the ESRF machine is particularly low
 (In ELETTRA, $I_{th} \sim 40 \text{ mA}$, i.e. equivalent of $\sim 12 \text{ mA}$ ESRF, with $\xi \sim 0$).

- Measurement of vertical dipole mode frequency with negative chromaticities:



Measurement of mode 0 growth time, using a gated feedback system.



Measured mode 0 frequency shift with chromaticity for different currents.

- Accumulation of single bunch current up to ~ 0.8 mA is possible at the ESRF with $\xi_V < 0$ thanks to a strong stabilising effect (amplitude-dependent tune shift) existing.
- Thanks to this fact, the complex mode 0 frequency was followed as a function of ξ_V , which is otherwise difficult due to the strong damping of mode 0 with $\xi_V > 0$.
- Measured growth time shows an expected trend (continuous shortening) up to $\xi_V = -0.5$ ($f_\xi \sim -14$ GHz), but nearly a factor of 4 longer than expected (i.e. R_T seems to be overestimated). Decomposition of the BB impedance into BBR and RW is in favour of reducing this discrepancy.
- Growth time measurement with $\xi_V < -0.5$ was not possible due to too weak beam signal for the feedback.
- Measured tune shift is also in basic accordance with the expectation (decreasing inductance with increasing $|f_\xi|$). An undesired optics tune shift with chromaticity had to be subtracted in the measurement.